MODULAR SLEEVE YOKE

This application is a C-I-P of Ser. No. 10/007,590 filed Dec. 10, 2001, which claims benefit of Prov. No. 60,274,147 filed Mar. 9, 2001.

BACKGROUND OF THE INVENTION

This invention relates to integration means, and more particularly to a device added to a firearm for incorporating ancillary equipment.

As the field of combat and commercial weaponry expands, numerous add-on enhancements have-become available for attachment to standard firearms thereby significantly upgrading the capability of the firearm. Various methods and means have been developed for interfacing the various add-on enhancements to firearms. Applicant's U.S. Pat. No. 5,142,806, incorporated herein by reference, discloses a universal receiver sleeve having an upper interface portion with standard, universal dimensions regardless of the firearm and having a lower interface portion specific to a particular firearm.

Although the principles of the above identified patented device are generally applicable to all firearms, the specific firearm example identified in the patent was the U.S. military M16 rifle and carbine. The M16 has been in service for a number of years and will continue to be a popular rifle both in the U.S. military and foreign military for the foreseeable future. However, with the increasing development and refinement of laser technology, it has become highly desirable to integrate laser technology capabilities onto and into firearms, especially the commonly used M16.

The problem with integrating laser technology to firearms is the inherent conflict between a gun barrel's physical functioning and the rigid environment required for laser operations. For maximum results, a gun barrel should be physically isolated, i.e., "floating". It is preferred that nothing be attached to the gun barrel, thereby isolating the barrel physically and eliminating bending and "droop" along the barrel's longitudinal axis. The ideal arrangement for lasers and ancillary optics and electronics is one of complete isolation from the gun barrel. The temperature of a gun barrel in use can rise to 900° F. This type of heat, as well as the physical shock on the gun barrel from firing, will quickly destroy lasers and ancillary optics and electronics.

The heat generated by the gun barrel transfers directly to any devices touching it thereby directly transferring enough heat to burn hands and destroy attached electrical devices. Further compounding this problem is the requirement that gun barrels be extra heavy to support the added weight attached by means of the collars. This in turn means more cantilevered stress on the barrel where it is joined with the M-16's aluminum receiver. The combination of heat and barrel weight tend to pull the barrel chamber out of alignment with the bolt lead, thereby causing bolt lug and extractor failure.

SUMMARY OF THE INVENTION

In view of the foregoing disadvantages inherent in the known types of devices now present in the prior art, the present invention provides a modular receiver sleeving system. As such, the general purpose of the present invention, which will be described subsequently in greater detail, is to provide a new and improved interface means for firearms which will isolate the gun barrel while providing various capabilities for mounting and integrating optics, lasers and sensors.

To attain this, the present invention extends the Swan universal receiver sleeve forward above the firearm barrel to a position just short of the firearm front sight. A weaver type interface return portion may be provided on the underside of the sleeve, or left solid over the barrel in front of the receiver to accommodate solid handguards or modular, dovetailed handguards. The underside of the rear portion of the sleeve is fixedly attached to the receiver top. The underside of the forward portion of the sleeve has an upper handguard piece attached thereto. A bottom handguard piece is fitted about the bottom of the gun barrel and is attached to the upper handguard piece via a unique channel and track system. The handguard pieces are not physically connected in anyway to the gun barrel. The sleeve is self supported by the connection of the rear portion underside to the receiver top. Laser, electronics and optics modules may optionally be attached to the sleeve top side or to the upper handguard piece via special male and female dovetail track devices. The barrel of the rifle is essentially free floating. This permits greater shooting accuracy and protects sensitive electrical components integrated into and onto the firearm via the invention. Lighter weight barrels can be utilized as they are no longer deflected by outside pressure and direct transfer of heat to the hand is also eliminated.

Although the modular sleeve is self supported by the connection of the rear portion underside to the receiver top, additional support may be provided by the addition of a special yoke about the barrel nut of the firearm to which the modular sleeve is attached. The special yoke of the present invention, reinforces the modular sleeve while keeping the firearm barrel free floating.

Specifically, the present invention is a modular sleeve for interfacing modular enhancements to a firearm, said firearm having minimally a receiver with a stock and barrel attached thereto, said barrel defining the forward portion of the firearm and said stock defining the rearward portion of the firearm, said firearm longitudinal axis being defined as horizontal and running from said stock through said receiver to said barrel, said receiver having a forward portion, a top and a rearward portion, said barrel being joined to the forward portion of the receiver, said stock being joined to the rearward portion of the receiver. The modular sleeve is made up of a universal receiver sleeve having a top side, an underside and two opposite sides connecting said top side with said underside, said universal receiver sleeve being further defined as having a forward portion and a rear portion, the underside of the rear portion of the universal receiver sleeve being fixedly attached to the firearm receiver top, said receiver sleeve,forward portion extended forward above the firearm barrel. The modular sleeve has an upper handguard piece with a front, rear, top, open bottom, opposing sides, outer side surfaces and inner side surfaces, said top, sides and bottom defining a hollow interior, said front and rear defining an upper handguard piece longitudinal axis, said upper handguard piece top being joined to the underside of the forward portion of the receiver sleeve. The modular sleeve also has a bottom handguard piece having a front, rear, open top, bottom, opposing sides, outer side surfaces and inner side surfaces, said bottom, sides and top defining a hollow interior, said front and rear defining a bottom handguard piece longitudinal axis, said bottom handguard piece being removably attached to the upper handguard piece. The upper handguard piece and attached bottom handguard piece surround the firearm barrel without touching said barrel. A special yoke is positioned about the firearm barrel nut of the firearm to which the modular sleeve is attached, said upper handguard piece rear being attached to

said special yoke. The special yoke is held in place on the barrel nut by attachment to the modular sleeve and the barrel nut. The special yoke may be further held in place by a delta ring with those firearms with a handguard delta ring.

The present invention provides a foundation for integrated laser fire control devices, sensors, communications, and a vast array of quickly attached ancillary devices, such as standard night vision, thermal, shot guns, grenade launchers, and other special systems.

The extra heavy barrels required on conventional rifles and carbines are no longer required with the present invention. A standard heavy or light weight barrel can be utilized because the present invention isolates and prevents hand, sling, and bipod pressure from deflecting the barrel. With the present invention, barrel handguards are not attached to the hot barrels, and provide a much cooler grip for the shooter. Weight reductions of at least one-half pound can be accomplished by use of a light weight barrel and the elimination of conventional solid aluminum and/or plastic handguards and their barrel hardware.

The modular sleeve is attached to the firearm upper receiver in a manner that provides a solid system, attachable or removable by a qualified armorer or a trained soldier. Greater accuracy is accomplished because the firearm has a free floating barrel with the instant invention and thereby no outside forces deflecting point of aim.

These together with other objects of the invention, along with various features of novelty which characterize the invention, are pointed out with particularity in the claims annexed hereto and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and the specific objects attained by its uses, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of a standard combat firearm.

FIG. **2** is a front perspective view of a universal receiver sleeve;

FIG. **3** is a front perspective view of the rear portion of the sleeve of FIG. **2**.

FIG. **4** is a front perspective view of a modular sleeve mounted on a firearm.

FIG. **5** is a front, exploded perspective view of a modular sleeve.

FIG. **6A** is a diagrammic front view of a modular sleeve, with bottom handguard attached, positioned about a rifle barrel.

FIG. **6B** is a diagrammic front view of another embodiment of a modular sleeve, with bottom handguard attached, positioned about a rifle barrel.

FIG. **6C** is a diagrammic front view of the modular sleeve of FIG. **6A** with dovetail interface element attached.

FIG. **7** is a bottom perspective view of the bottom handguard.

FIG. **8** is a top perspective view of the upper handguard.

FIG. **9** is a top sectional view of the bottom handguard with exploded attachment element.

FIG. **10** is a top sectional view of the bottom handguard with attachment element.

FIG. **11** is sectional view of the interior of the bottom handguard.

FIG. **12** is a close-up view of a section of the bottom handguard.

FIG. **13** is a front, top perspective view of the bottom handguard.

FIG. **14** is a rear perspective view of the modular sleeve.

FIG. **15** is a rear perspective view of another embodiment of the modular sleeve.

FIG. **16** is an exploded view of the modular sleeve embodiment of FIG. **15**.

FIG. **17** shows a side elevational view of the connection between the firearm barrel and the firearm receiver.

FIG. **18** provides a disassembled, or exploded, view of the parts of the assembly shown in FIG. **17**.

FIG. **19** is a side elevational view of the various parts of the assembly shown in FIG. **18**.

FIG. **20** is a front elevational view of each of the parts shown in FIG. **19**.

FIG. **21A** is a front elevational view of the special yoke of the present invention.

FIG. **21B** is a rear elevational view of the special yoke of the present invention.

FIG. **21C** is a bottom view of the special yoke of the present invention.

FIG. **21D** is a top view of the special yoke of the present invention.

FIG. **21E** is a side elevational view of the special yoke of the present invention.

FIG. **22** is a sectional side view along the line **22**—**22** of FIG. **21B**.

FIG. **23A** is a front, perspective view of the upper hand guard piece.

FIG. **23B** is a rear perspective view of the upper hand guard piece.

FIG. **24** is a side view, partly in section, of the special yoke engaging the firearm barrel nut.

FIG. **25** is a bottom view of the yoke engaged to the barrel nut.

FIG. **26A** is a front elevational view of another embodiment of the special yoke of the present invention.

FIG. **26B** is a rear elevational view of the special yoke of FIG. **26A**.

FIG. **26C** is a bottom view of the special yoke of FIG. **26A**.

FIG. **26D** is a top view of the special yoke of FIG. **26A**.

FIG. **26E** is a side elevational view of the special yoke of FIG. **26A**.

FIG. **27** is a sectional side view along the line **27**—**27** of FIG. **26B**.

FIG. **28A** is a front, perspective view of another embodiment of the upper hand guard piece.

FIG. **28B** is a rear perspective view of the upper hand guard piece of FIG. **28A**.

FIG. **29** is a side view, partly in section, of the second embodiment special yoke engaging the firearm barrel nut.

FIG. **30** is a bottom view of the second embodiment special yoke engaged to the barrel nut.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings in detail wherein like elements are indicated by like numerals, there is shown in FIG. **1** an

outline of a conventional combat firearm **10** having a conventional stock **11**, upper receiver **12** with flat top **13**, lower receiver **17**, barrel **16**, pistol grip **7**, and magazine **9**. The barrel **16** is joined to the upper receiver **12**. The barrel **16** defines the forward portion of the firearm **10** and the stock **11** defines the rearward portion of the firearm **10**. The longitudinal axis of the firearm **10** runs from stock **11** through receiver **12**, **17** to barrel **16**. The barrel **16** is joined to the forward portion **14** of the upper receiver **12**, i.e., the upper receiver **12** "receives" the barrel **16**. The stock **11** is joined to the rear portion **15** of the upper receiver **12**. The barrel **16** has protective handguards **18** about its circumference.

As shown more particularly in FIGS. **17–20**, the firearm barrel **16** is detachably secured to a screw-threaded barrel port **160** at the front of the upper receiver forward portion **14** by means of a barrel nut assembly **161**. The barrel nut assembly **161** is comprised of a barrel nut **170**, a delta ring **162**, a delta ring spring **163**, and a delta ring lock washer **164**. The delta ring **162** is used to hold conventional handguards (not shown) in place. As may be best seen in FIG. **20**, the tops of the barrel nut **170**, delta ring **162**, delta ring spring **163** and delta ring lock washer **164** are either notched or open to accommodate the firearm's gas tube (not shown). When the barrel nut assembly **161** is assembled as shown in FIG. **17**, the spring **163** urges the delta ring **162** over the barrel nut **170**.

The present invention provides a modular sleeve **1** about the firearm barrel **16** replacing the firearm's conventional handguards with a handguard assembly integrated into the modular sleeve **1**. The present invention is anchored by the universal receiver sleeve **2** disclosed in applicant's U.S. Pat. No. 5,142,806, issued on Sep. 1, 1992, "Universal Receiver Sleeve", to Richard E. Swan, and incorporated herein by reference.

Referring more particularly to FIGS. **2** and **3**, a universal receiver sleeve **2** is fully illustrated. FIG. **2** illustrates a full universal receiver sleeve **2** comprised of a front portion **3**, a rear portion **4** and two sides **5**. FIG. **3** illustrates the receiver rear portion **4** only. The receiver sleeve rear portion **4** only is actually joined to the upper receiver **12**. The rear portion **4** is attached to the upper receiver **12** by means of one or more fasteners **33** joined through the sleeve sides **5** across the receiver top **13**. The sleeve front portion **3** extends forwardly over the firearm barrel **16**. The Swan sleeve **2** has a top section **20** (see FIGS. **2** and **3**) and a bottom section **40** (see FIG. **3**) and a longitudinal axis extending in spaced, parallel relation to the longitudinal axis of the firearm **10**. The receiver sleeve top section **20** has a longitudinal, horizontally positioned base portion **21** along its length. The base portion **21** has two long side edges **29**. A first longitudinal rail **22** extends upward from the base portion **21** adjacent one of the long side edges **29** and a second longitudinal rail **23** extends upward from the base portion **21** adjacent the other of the long side edges **29**. The second rail **23** is in spaced parallel relationship to the first rail **22**. A longitudinal opening, i.e., channel **28**, is formed between the first and second rails **22**, **23**. The upper surface **24** of the first rail **22** lies on the same horizontal plane as the upper surface **25** of the second rail **23**. Optional notches **26** may also be provided in the rails **22**, **23**. The notches **26** provide additional means of engaging other components. The quantity and placement of pairs of notches **26** are as required or needed. Each of the two long side edges **29** of the base portion **21** and rails **22**, **23** are integral with external angled engagement surfaces **30** which extend the full length of the top section **20**.

The receiver sleeve top section **20** is joined to the receiver sleeve bottom section **40**. The receiver sleeve bottom section also has a longitudinal, horizontally positioned base portion **41** along its length. The base portion **41** has two long side edges **49**. A first rail **42** extends downward from the base portion **41** adjacent one of the long side edges **49** and a second rail **43** extends down-ward from the base portion **41** adjacent the other of the long side edges **49**. The second rail **43** is in spaced parallel relationship to the first rail **42**. The top section base **21** is joined in a mirrored, face to face relationship to the bottom section base **41**. The lower surface **44** of the first rail **42** lies on the same horizontal plane as the lower surface **45** of the second rail **43**. Each of the two long side edges **49** of the base portion **41** and the rails **42**, **43** are integral with an angled engagement surface **50** which extends the full length of the bottom section **40**. A longitudinal resultant channel **48** is formed between the integrated rail-angled engagement surfaces **42**, **50** and **43**, **50**. The cross section shape of the channel **48** will vary from firearm to firearm depending on the upper receiver top **13** contour of the particular firearm. The channel **48** is the interface and engagement means between the receiver sleeve **2** and the firearm **10** or the sleeve **2** and other firearm ancillary elements. The nominal cross section of the channel **48** and the cross section of the receiver sleeve top section **20** are identical. This permits complex integration of various modules to a firearm **10**. In this embodiment of the invention the channel cross section provides a weaver type interface return.

The present invention provides for extension of the receiver sleeve **2** forward above the firearm barrel **16** to a position just short of the firearm front sight **19**. This is the sleeve front portion **3** described above. The receiver sleeve bottom section **40** may be a weaver type interface or left solid over the barrel **16** in the receiver front portion **3** to accommodate solid handguards or modular, dovetailed handguards. The bottom section **40** of the rear portion **4** of the sleeve **2** has a weaver type interface and is fixedly attached to the receiver top **13**. In the present invention the bottom section **40** of the front portion **3** of the sleeve **2** has an upper handguard piece **50** attached thereto. A bottom handguard piece **70** is fitted about the bottom of the gun barrel **16** and is attached to the upper handguard piece **50**. The handguard pieces **50**, **70** are not physically connected in any way to the gun barrel **16**. The sleeve **2** is self supported by the joining of the sleeve rear portion **4** bottom section **40** to the receiver top **13**. In another embodiment of the invention shown in FIG. **6A** the top of the **53** upper handguard **50** and receiver sleeve bottom section **40** may be integrated into one piece, thereby forming a resulting upper handguard piece top **53**, said resulting upper handguard piece top having an upper surface **49** and an undersurface **59**. Laser, electronics and optics modules may optionally be attached to the sleeve top section **20** or to the upper handguard piece **50** via special male and female dovetail track devices. The barrel **16** of the firearm **10** is essentially free floating. This permits greater shooting accuracy and protects sensitive electrical components integrated into and onto the firearm. Lighter weight barrels can be utilized as they are no longer deflected by outside pressure and direct transfer of heat to the hand is eliminated.

As may also be seen in FIGS. **2** and **3**, in practice, the receiver sleeve rear portion **4** would incorporate a standard non-optical, flip up sight **6** at the rear **35** of the receiver top section **20**. Windage and elevational adjustments **36** and **37** may also be included. Although for illustrative purposes the flip up sight **6** is not shown in the modular sleeve figures, as

a desired feature, a flip up sight would normally be included with the modular sleeve **1**.

Referring more particularly to FIGS. **4–16**, the upper handguard piece **50** has a front **51**, rear **52**, top **53**, open bottom **54**, opposing sides **55**, outer side surfaces **56** and inner side surfaces **57**, said top **53** and sides **55** defining an interior **58**. The front **51** and rear **52** define the upper handguard piece's longitudinal axis. The top **53** may be formed into a male weaver type interface. Each of the upper handguard side outer surfaces **56** have two longitudinal channels formed therein, i.e., a large and shallow upper channel **60** and a bottom interface channel **61**. The concave shape formed in the upper handguard piece by the channel **60** permits heat to escape faster from the firearm barrel area. The channel also permits ancillary equipment to be placed closer to the center line of the barrel bore. The bottom interface channel **61** is positioned near to the bottom **54** and has a general female, T-shaped cross section.

The bottom handguard piece **70** has a front **71**, rear **72**, open top **73**, bottom **74**, opposing sides **75**, outer side surfaces **76** and inner side surfaces **77**, said bottom top **74** and sides **75** defining an interior **78**. The front **71** and rear **72** define the bottom handguard piece's longitudinal axis. The bottom **74** may be formed into a male weaver type interface. Each of the bottom handguard side outer surfaces **76** have two longitudinal channels formed therein, i.e., a small and shallow upper channel **80** and a larger, shallow bottom channel **81**. The channels **80, 81** provide hand gripping means for a user.

The upper handguard rear **52** and bottom handguard piece rear **72** may be shaped to accommodate various firearm barrel-receiver connection means. FIG. **14** illustrates an example of a military application for a firearm which has the normal handguard delta ring **162** removed. FIG. **15** illustrates a typical commercial application wherein the firearm normal handguard delta ring **162** has not been removed. This requires that the upper handguard piece rear **52** be cut back more than the military version shown in FIG. **14** in order to accommodate the delta ring **162**.

The bottom hand guard inner side surfaces **77** each have a longitudinal T-shaped protrusion **82** position near to the top **73**, each protrusion being a mirror of the other. The bottom handguard piece **70** is adapted to being joined to the upper handguard piece **50** by sliding the bottom handguard longitudinal T-shaped protrusion **82** into the upper handguard bottom interface channel **61**.

Referring more particularly to FIGS. **9–13**, spring-loaded connectors **88** are inserted through the bottom handguard piece sides **75** to hold the handguard pieces **50, 70** in proper alignment.

Apertures **62** may be formed in the upper handguard shallow upper channel **60** for heat ventilating purposes. The upper handguard rear **52** may also be tapered back toward the top **53** to add strength to the invention. Apertures **84** may also be formed in the lower handguard lower channel **81** for heat ventilating purposes.

Referring particularly to FIGS. **6A** and **6B**, the lower handguard piece left and right T-shaped protrusions **82** engage the upper handguard piece bottom interface channels **61**. In one embodiment of the invention, the bottom handguard piece **70** is positioned fully to the upper handguard piece front **51** and then brought back rearwardly in order to have the lower handguard piece left and right T-shaped protrusions **82** engage the upper handguard piece bottom interface channels **61**. To eliminate this requirement, the invention embodiment shown provides for an interrupted interface railing system comprised of cutout portions **65, 85** in the upper handguard interface channel **61** and bottom handguard upper channel **80**. Each remaining stud **66, 86** of the interface channel **61** and channel **80** is a nominal ¾ inch in longitudinal length. The cutout portions **65, 85** are also a nominal ¾ inch in longitudinal length. This allows the lower handguard piece **70** to be placed a nominal ¾ inch forward of and in alignment with the upper handguard piece **50**. The lower handguard piece **70** is then pulled back rearwardly ¾ inch. The studs **66, 86** then fully engage and lock into one another.

Referring more particularly to FIGS. **5, 6A, 6B, 8,** and **14–16**, the upper handguard piece top **53** and/or receiver sleeve front portion **3**, may have a longitudinal gap **130** formed therein. This permits the direct attachment of various aiming, optical and directed energy devices to the upper handguard top **53**, or the attachment of various interface longitudinal elements **131** adapted and configured to join various aiming, optical and directed energy devices to the modular sleeve upper handguard piece top **53**. See FIG. **8**. The gap **130** provides room to compensate for various height requirements for the various devices. The gap **130** is most clearly shown in FIG. **14**. An interface element **131** attached to the gap **130** is most clearly shown in FIG. **15**. In another embodiment of the invention shown in FIG. **16**, a hinging element **132** is fixed to the upper handguard piece top **53** at the front **51** and is adapted to pivotally join an interface element **131** which may have different attachment configurations on each surface.

Referring more particularly to FIGS. **6C**, and **9–13**, the modular sleeve is further enhanced wherein several of the studs **86** of the bottom handguard piece **70** are reduced in longitudinal length to a nominal ½ inch. This permits engagement of an external dovetail interface element **90**. Each external dovetail interface element **90** has an exterior horizontal surface **91** with a cross-sectional dovetail shape adapted to attach ancillary equipment, and an opposite, generally flat, interior surface **93** having one or more T-shaped protrusion **92** adapted to engage the cutout portions **85** of the lower handguard upper channels **80** and come into alignment with the studs **86** for engagement with the upper handguard interface channel **61**. Any number of studs **86** may be modified in any nominal longitudinal length to accommodate dovetail interface elements **90** of varying lengths. The dovetail interface elements **90** also have one or more apertures **94** formed therethrough, said apertures **94** adapted to receive a screw **96**. The screw **96** enables a dovetail interface element **90** to be engaged directly to the modular sleeve **1** at one of the apertures **98** formed directly at various points in the modular sleeve **1**. The modular sleeve apertures **98** may have helicoils **99** inserted therein to provide threaded engagement with a screw **96**.

The receiver top **13** has a plurality of notches **8** formed thereon, each said notch **8** having a rectangular cross section and are formed transverse to the longitudinal axis of the firearm **10**. The universal receiver sleeve **2** has an elongated rectangular opening **150** formed in a first universal receiver sleeve opposite side **5**, said rectangular opening **150** extending from the universal received sleeve opposite side lower surface **45** a predetermined distance toward the universal receiver top side **25** terminating in a rectangular opening upper edge **151**, said rectangular opening upper edge having a plurality of rectangular notches **141** formed therein. The second universal receiver sleeve opposite side **5'** has a plurality of apertures **152** formed therein, each said aperture **152** being formed directly opposite a first universal received sleeve opposite side rectangular notch **141**.

A sleeve dovetail interface element **140** is provided for engagement with the universal receiver sleeve rear portion **4**. The sleeve dovetail interface element **140** has an exterior horizontal surface **142** with a unique cross-sectional dovetail shape adapted to attach ancillary equipment, and an opposite interior surface **143** with a standard dovetail configuration for securing the universal receiver sleeve rear portion **4** to the receiver top **13**. There are a plurality of projecting elements **144** formed on the sleeve dovetail interface element interior surface **143**, each said projecting element **144** having a rectangular cross-section, said projecting elements **144** adapted to engage the notches **8** across the receiver top **13**. The sleeve dovetail interface element interior surface **143** is adapted to engage said universal receiver sleeve opposite side elongated opening **150** and a side **153** of said receiver top **13**. The sleeve dovetail interface element interior surface projecting elements **144** are adapted to engage the elongated rectangular opening rectangular notches **141**, the receiver top notches **8** and the apertures **152** in said second received sleeve opposite side **5'**. Special nuts **145**, each adapted to engage a portion of a sleeve dovetail interface element interior surface projecting element projecting through each aperture **152** are also provided. The sleeve dovetail interface element **140** permits devices to be secured to the side of a firearm, adjacent to the upper receiver without interfering with the functions or handling of the firearm.

Referring more particularly to FIGS. **17–25**, the firearm barrel **16**. is detachably secured to a screw-threaded barrel port **160** at the front of the upper receiver forward portion **14** by means of a barrel nut assembly **161**. The assembly barrel nut **170** has a generally cylindrical body **174** with a central longitudinal threaded opening **171** permitting the nut to be slid over the firearm barrel **16** and cooperatively engaging a flange (not shown) on the barrel **16**. Said barrel nut threaded opening **171** adapted to engage the screw-threaded barrel portion **160** at the front of the upper receiver forward portion **14**. The barrel nut **170** has a forward end **172** with a number of prongs **173** protruding radially outward from the barrel nut body **174**. The barrel nut prongs **173** are adapted to be engaged by a wrench to tighten or loosen the barrel nut **170**.

The special yoke **180** is a U-shaped device having two upright elements **181** interconnected by a curvilinear element **182**. The special yoke **180** has a top **183**, bottom **184**, front **185**, rear **186** and two opposite sides **187**. The curvilinear element **182** contains the yoke bottom **184**. The upright elements **181** terminate at the yoke top **183**. In this embodiment of the invention, the upright elements **181** are generally rectangular block-like elements protruding forwardly away from the special yoke rear **186**. The side **187** of each upright element **181** each has at least one threaded, lateral aperture **188** formed therethrough. Other embodiments could have more than one lateral aperture. The side **187** of each upright element **181** also has an indentation **189** formed therein about each said aperture **188**. The indentation **189** is adapted to receive a screw head. The rear **186** of the curvilinear element **182** has a channel flange **190** formed at the yoke bottom **184** opening upward. The channel flange **190** and yoke bottom **184** have a rectangular notch **191** formed therein.

As may be best seen from FIG. **24**, the special yoke **180** is positioned in front of the barrel nut **170** so that the special yoke rear **186** is against the barrel nut forward end **172**. The rear **186** of the special yoke channel flange **190** is positioned to engage the barrel nut body **174** while the channel **190** covers the lower half prongs **173** without actually touching the prongs **173**. The special yoke of FIG. **22** corresponds to the view shown in FIG. **24**.

FIG. **25** is a bottom view of the special yoke **180** engaged to the firearm barrel nut **170** with only two prongs **173** visible through the special nut notch **191**. The bottom handpiece **70** has been removed and only a portion of the upper handguard piece **50** is visible. As may be seen from both FIGS. **24** and **25**, once the special yoke **180** engages the barrel nut **170**, the delta ring **162**, which is spring loaded and is held back with a screw driver or the like while the special yoke **180** is installed, is released and moves forward substantially covering the barrel nut **170** and a portion of the special yoke **180**. The special yoke notch **191** provides access for a screw driver or other tool in manipulating the delta ring **162** and special yoke **180**. On those firearms with the delta ring **162** removed, the special yoke **180** is positioned exactly the same way over the barrel nut **170**.

As may be seen from FIGS. **23A** and **23B**, the upper handguard piece **50** has a small, circular horizontal aperture **63** formed through each upper hand guard piece side **55** near to the rear **52** in the bottom interface channel **61**. Referring again to FIG. **25**, threaded screws **195** are inserted through the upper handguard piece small, circular horizontal apertures **63** for threaded engagement with the special yoke lateral apertures **188**. The upper handguard piece **50** is then supported not only by the rear portion underside **40** to the receiver top **13**, but also by the engagement of the upper handguard piece **50** with the special yoke **180**. The special yoke **180** is joined to the barrel nut **170** and optionally held in position by the delta ring **162**. The special yoke **180** does not touch the firearm barrel **16**. Additional downward pressure on the upper handguard piece top **53** translates by means of the special yoke **180** to the firearm barrel nut **170**. The firearm barrel nut **170** and special yoke **180** are made from steel thereby slowing down heat transfer from the firearm barrel **16** to the aluminum upper receiver **12**.

In another embodiment of the invention, the special yoke upright elements **181** have generally rectangular block-like elements **192** protruding laterally sideways. See FIGS. **26A–27**. The top **193** of each laterally protruding element **192** each has a threaded, vertical aperture **188** formed therethrough. The top **193** of each laterally protruding element **192** also has an indentation **189** formed therein about each said aperture **188**. Each indentation **189** is adapted to receive a screw head. As may be seen from FIGS. **28A** and **28B**, in this embodiment of the invention the upper handguard piece **50** has a small, circular, vertical aperture **63** formed through the longitudinal element **64** along each upper hand guard piece side **55** separating the shallow upper channel **60** from the bottom interface channel **61**. The aperture **63** is formed near to the rear **52** of the upper hand guard piece **50**. A notch **67** is also formed in the upper handguard piece cut out portion **65** at the upper handguard rear **52**. The special yoke laterally protruding elements **192** each engage an upper handguard piece notch **67**. Referring also to FIGS. **29** and **30**, threaded screws **195** are inserted through the upper handguard piece small, circular, vertical apertures **63** for threaded engagement with the special yoke vertical apertures **188**. The upper handguard piece **50** is then supported not only by the rear portion underside **40** to the receiver top **13**, but also by the engagement of the upper handguard piece **50** with the special yoke **180**. The special yoke **180** is joined to the barrel nut **170** and optionally held in position by the delta ring **162**. The special yoke **180** does not touch the firearm barrel **16**. Additional downward pressure on the upper handguard piece top **53** translates by means of the special yoke **180** to the firearm barrel nut **170**. The firearm barrel nut **170** and special yoke **180** are made from steel thereby slowing down heat transfer from the firearm barrel **16** to the aluminum upper receiver **12**.